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EXAMINER	
NGUYEN, KHIEM D	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 05/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/838,493	Applicant(s) DINESH CHOPRA	
	Examin r Khiem D Nguyen	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover she t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 04 March 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-9,11-14,16-41 and 43-57 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-9,11-14,16-41 and 43-57 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 19 April 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 030404.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Response to Amendment

Response to Arguments

Applicant's arguments with respect to claims 1-9, 11-14, 16-41, and 43-57 have been considered but are moot in view of the new ground(s) of rejection.

New Grounds of Rejection

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Chen (U.S. Patent 6,632,345).

In re claim 1, **Lopatin** discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer **(FIG. 3: 232)** on the substrate wherein a first purpose is to serve as a barrier laver and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer **(FIG. 3: 236)** on the surface of the dual- purpose layer using a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte includes a cation species of material of an anode in an electrochemical reaction cell.

Chen discloses electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte includes a cation species of material of an anode in an electrochemical reaction cell and electrochemically depositing a conductive interconnect layer on the surface of the dual-purpose layer using a second electrolyte, wherein the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrochemically reduce the oxides (col. 3, line 46 to col. 5, line 48 and **FIGS. 1-3**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Chen to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore to provide an excellent conformal copper coating that allows trenches and vias to be subsequently filled with a copper layer having good uniformity using electrochemical deposition techniques (col. 3, lines 33-44).

In re claim 2, **Lopatin** discloses wherein the dual-purpose layer comprises a material capable of reducing diffusion of the conductive interconnect material into surrounding materials, and wherein the dual-purpose layer comprises a material having a resistivity that allows electrochemical deposition of the conductive interconnect material (col. 5, line 19 to col. 6, line 54).

In re claims 3 and 4, **Lopatin** discloses wherein the dual-purpose layer comprises a material selected from the group consisting of tungsten (col. 6, lines 49-51).

In re claim 5, **Lopatin** discloses wherein the conductive interconnect material comprises copper (col. 6, lines 54-63).

In re claim 6, there is no evidence indicating the voltage range applied and time duration during both the electrochemically reducing step and the electrochemically depositing step are critical and it has been held that it is not inventive to discover the optimum or workable range or time duration of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claims 7-9, similar as expressed in claim 6 above, there is no evidence indicating the range of the current applied during both the electrochemically reducing step and the electrochemically depositing step is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

2. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Chen (U.S. Patent 6,632,345).

In re claim 12, **Lopatin** discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer **(FIG. 3: 232)** on the substrate wherein a first purpose is to serve as a barrier laver and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing

a conductive interconnect layer **(FIG. 3: 236)** on the surface of the dual- purpose layer using a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer in an electrochemical reaction cell comprising an anode formed from a material that can be oxidized in the presence of the material comprising the dual-purpose layer and wherein the electrochemical reaction cell contains a first electrolyte comprising the cation of the material used to from the anode, and the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrically reduce the oxides.

Chen discloses electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte includes a cation species of material of an anode in an electrochemical reaction cell and electrochemically depositing a conductive interconnect layer on the surface of the dual-purpose layer using a second electrolyte, wherein the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrochemically reduce the oxides (col. 3, line 46 to col. 5, line 48 and **FIGS. 1-3**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Chen to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore to provide an excellent conformal copper coating that allows trenches and vias to be subsequently filled with a copper layer having good uniformity using electrochemical deposition techniques (col. 3, lines 33-44).

In re claim 11, **Lopatin** discloses wherein the anode is formed from titanium (col. 6, lines 49-54).

In re claims 13 and 14, **Lopatin** discloses wherein the anode comprises titanium (col. 6, lines 49-54) and Lashmore discloses wherein the first electrolyte comprises titanium trichloride, titanium sulfate, titanium bromide, titanium trichloride, titanium iodide, titanium fluoride, or mixtures thereof.

3. Claims 16-25 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Chen (U.S. Patent 6,632,345).

In re claim 25, **Lopatin** discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer **(FIG. 3: 232)** on the substrate wherein a first purpose is to serve as a barrier laver and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer **(FIG. 3: 236)** on the surface of the dual- purpose layer using a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte in an electrochemical bath having an anode and a cathode and wherein the first electrolyte contains the cationic species of the material comprising the first anode, and the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrochemically reduce the oxides.

Chen discloses electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte includes a cation species

of material of an anode in an electrochemical reaction cell and electrochemically depositing a conductive interconnect layer on the surface of the dual-purpose layer using a second electrolyte, wherein the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrochemically reduce the oxides (col. 3, line 46 to col. 5, line 48 and **FIGS. 1-3**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Chen to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore to provide an excellent conformal copper coating that allows trenches and vias to be subsequently filled with a copper layer having good uniformity using electrochemical deposition techniques (col. 3, lines 33-44).

In re claims 16, **Lopatin** and **Chen** discloses wherein the electrochemically reducing step is performed in a first electrochemical reaction cell and the electrochemically depositing step is performed in a second electrochemical reaction cell (Lopatin, col. 5, line 62 to col. 6, line 43) and (Chen, col. 3, col. 5, lines 15-48).

In re claim 17, **Chen** discloses wherein the electrochemically reducing step and the electrochemically depositing step are performed in a single electrochemical reaction cell (col. 5, lines 15-48 and **FIGS. 1-3**).

In re claim 18, **Lopatin** and **Chen** disclose wherein the electrochemical reducing step is performed using a first anode and the electrochemical depositing step is performed using a second anode (Lopatin, col. 5, line 62 to col. 6, line 43) and (Chen, col. 5, lines 15-48 and **FIGS. 1-3**).

In re claim 19, **Lopatin** and **Chen** disclose wherein the electrochemical reducing step and the electrochemical depositing step are performed using a single anode. Lopatin, col. 5, line 62 to col. 6, line 43) and (Chen, col. 5, lines 15-48).

In re claims 20 and 21, **Lopatin** discloses wherein the dual-purpose layer comprises a material selected from the group consisting of tungsten (col. 6, lines 49-51).

In re claim 22, **Lopatin** discloses wherein the conductive interconnect material comprises copper (col. 6, lines 54-63).

In re claims 23-24, **Lopatin** discloses wherein the first anode is formed from titanium (col. 6, lines 49-54).

In re claim 28, there is no evidence indicating the voltage range applied and time duration during both the electrochemically reducing step and the electrochemically depositing step are critical and it has been held that it is not inventive to discover the optimum or workable range or time duration of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claims 29-31, similar as expressed in claim 28 above, there is no evidence indicating the range of the current applied during both the electrochemically reducing step and the electrochemically depositing step is critical and it has been held that it is not

inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

4. Claims 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Chen (U.S. Patent 6,632,345).

In re claims 26 and 27, **Lopatin** discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer **(FIG. 3: 232)** on the substrate wherein a first purpose is to serve as a barrier laver and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer **(FIG. 3: 236)** on the surface of the dual-purpose layer utilizing a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte.

Chen discloses electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte includes a cation species of material of an anode in an electrochemical reaction cell and electrochemically depositing a conductive interconnect layer on the surface of the dual-purpose layer using a second electrolyte, wherein the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrochemically reduce the oxides (col. 3, line 46 to col. 5, line 48 and **FIGS. 1-3**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Chen to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and

furthermore to provide an excellent conformal copper coating that allows trenches and vias to be subsequently filled with a copper layer having good uniformity using electrochemical deposition techniques (col. 3, lines 33-44).

Additionally, **Lopatin** discloses wherein the anode comprises titanium (col. 6, lines 49-54) and **Chen** discloses wherein the first electrolyte comprises titanium trichloride, titanium sulfate, titanium bromide, titanium trichloride, titanium iodide, titanium fluoride, or mixtures thereof (col. 5, lines 15-48).

5. Claims 32-41 and 43-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Chen (U.S. Patent 6,632,345).

In re claim 32, 44, 45, and 47, **Lopatin** discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer **(FIG. 3: 232)** on the substrate wherein a first purpose is to serve as a barrier layer and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer **(FIG. 3: 236)** on the surface of the dual- purpose layer utilizing a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte, and that the conductive interconnect layer including conductive material other than a cation species in the first electrolyte used to electrochemically reduce the oxides.

Chen discloses electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte includes a cation species of material of an anode in an electrochemical reaction cell and electrochemically

depositing a conductive interconnect layer on the surface of the dual-purpose layer using a second electrolyte, wherein the conductive interconnect layer includes conductive material other than the cation species in the first electrolyte used to electrochemically reduce the oxides (col. 3, line 46 to col. 5, line 48 and **FIGS. 1-3**); and wherein the second electrolyte comprises: the cation of the material from which the conductive is made; a complexing agent; and a pH control agent. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Chen to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore to provide an excellent conformal copper coating that allows trenches and vias to be subsequently filled with a copper layer having good uniformity using electrochemical deposition techniques (col. 3, lines 33-44).

Additionally, **Chen** discloses wherein both the electrochemically reducing step and the electrochemically depositing step are performed in a single electrochemical reaction cell utilizing a single electrolyte (col. 5, lines 15-48 and **FIGS. 1-3**).

In re claims 33 and 45, **Lopatin** discloses wherein the conductive interconnect layer comprises copper (col. 6, lines 54-63) and the electrolyte comprises copper sulfate.

In re claims 34-35 and 46-47, **Chen** discloses wherein the complexing agent is selected from the group consisting of boric acid (col. 5, lines 42-48).

In re claims 36-37 and 48-49, **Chen** discloses wherein the pH control agent is tetramethyl ammonium hydroxide, ammonium hydroxide, or potassium hydroxide (col. 5, lines 33-41).

In re claims 38-41 and 50-53, there is no evidence indicating the pH level is critical and it has been held that it is not inventive to discover the optimum or workable level of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

In re claim 54, there is no evidence indicating the voltage range applied and time duration during both the electrochemically reducing step and the electrochemically depositing step are critical and it has been held that it is not inventive to discover the optimum or workable range or time duration of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claims 55-57, similar as expressed in claim 54 above, there is no evidence indicating the range of the current applied during both the electrochemically reducing step and the electrochemically depositing step is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

Response to Amendment

Response to Arguments

Applicant's arguments with respect to claims 1-9, 11-14, 16-41, and 43-57 have been considered but are moot in view of the new ground(s) of rejection.

Applicant contends that Lashmore does not teach or suggest of electrochemically reducing a surface using an electrolyte containing a cation species that is different than the material being deposited since neither Lopatin or Lashmore teach or suggest depositing a condutive interconnect layer on the surface of the dual-purpose layer, where the conductive interconnect layer includes conductive material other than the cation species in the electrolyte used to electrochemically reduce oxide.

In response to Applicant's contention that neither Lopatin or Lashmore teach or suggest depositing a conductive interconnect layer on the surface of the dual-purpose layer, where the conductive interconnect layer includes conductive material other than the cation species in the electrolyte used to electrochemically reduce oxide, examiner respectfully disagree. Applicant is directed to pages 2-3 of the present Office Action, where the newly discovered reference Chen (U.S. Patent 6,632,345) herein known as Chen discloses this claimed limitation. For these reasons, examiner holds the rejection proper.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR

1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (571) 272-1865. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (571) 272-1855. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
May 12, 2004

W. DAVID COLEMAN
PRIMARY EXAMINER